Journal of Sedimentary Research

Journal of Sedimentary Research, 2010, v. 80, 852–866
Research Article
DOI: 10.2110/jsr.2010.078

SEDIMENTARY ARCHITECTURE IN MEANDERS OF A SUBMARINE CHANNEL: DETAILED STUDY OF THE PRESENT CONGO TURBIDITE CHANNEL (ZAIANGO PROJECT)

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ABSTRACT: **Sinuous deep-water channels are recognized in most large deep-sea fans in the world. They present a particular interest to oil companies, since they are significant hydrocarbon reservoirs in deep offshore environments. The understanding of their geometries and their internal sedimentary architecture is necessary to better characterize reservoir heterogeneity of sinuous submarine channels. Therefore, numerous studies have been undertaken recently to better understand the behavior and sedimentary architecture of deep-water channels.**

The aim of this paper is to present our results concerning the development of the meandering channel of the present Congo turbidite system (or Zaire turbidite system). The study is based on high-resolution data including multibeam bathymetry, seismic lines, echosounder profiles, high-resolution side-scan sonar images, and gravity cores, collected by IFREMER along the submarine Congo channel between 1994 and 2000, during Guiness and ZaiAngo surveys.

The present Congo turbidite channel is a long incised turbidite channel. It is presently active. It has been built gradually by progradation of the distal depositional area. The most distal part of the channel is the youngest part and shows an immature morphology: the channel presents a low incision and a low sinuosity. In contrast, the upper part of the channel has undergone a long evolutionary history. Its pathway is mature and complex, with numerous abandoned meanders visible in the morphology.

This paper presents evidence of progressive channel migration and meander development of the Congo channel. It describes and explains the presence of terraces inside the channel. The detailed characterization of channel morphology and migration geometry shows that the evolution of the channel path is very similar to fluvial meandering systems with (1) lateral meander extension or growing, (2) downstream translation of the thalweg, and (3) meander cutoff.

Seismic and 3.5 kHz echosounder profiles show that the terraces, which are visible in the seafloor morphology, are not the imprints of incisional processes. Terraces are true depositional units infilling the channel. They are built during and after the lateral migration of the channel. They are composed of (1) point-bar deposits and (2) inner-levee deposits aggrading above the point bar deposits. Point-bar deposits are characterized by low-angle oblique reflectors forming deposits with a sigmoidal shape. They seem very similar to those observed in fluvial systems. The similarity between fluvial and turbidite point bars suggests that the basal part of the turbidity currents flowing in this channel can be considered as very similar to river flow.

With the high-resolution dataset collected in a present Congo turbidite channel, we provide a new description of the channel morphology and evolution, at a "reservoir" scale, intermediate between outcrop observations and 2D and 3D seismic data. The detailed interpretation of intrachannel sedimentation, associated with lateral channel migration, also provides new data for interpretation of flow dynamics in submarine meandering channels.

INTRODUCTION

Meandering deep-water channels have been observed at the surfaces of most of large deep-sea fans in the world: the Amazon Fan (Damuth et al. 1983; Flood and Damuth 1987; Pirmez and Flood 1995), the Mississippi Fan (Kastens and Shor 1986; Pickering et al. 1986), the Bengal Fan (Hübscher et al. 1997; Schwenk et al. 2003), the Indus Fan (Kenyon et al. 1995; Kolla and Coumes 1987), the Nile Fan (Loncke et al. 2002), and the Rhône Fan (Droz and Bellaiche 1985; Torres et al. 1997). Submarine meandering channels present a particular interest to oil companies, since they are significant hydrocarbon reservoirs in deep offshore environments. The understanding of their geometries and their internal sedimentary architecture is necessary to better characterize reservoir heterogeneity. Therefore, numerous works have recently been carried out by both industrial and academic researchers to understand the behavior and sedimentary architecture of sinuous deep-water channels, including different approaches: study of modern deep-water channels, outcrop analysis (Arnott 2007; Labourdette et al. 2008), 3D seismic studies (Abreu et al. 2003; Deptuck et al. 2007; Kolla 2007), and numerical and

* Bruno Savoye, the second author, died in august 2008. This article is dedicated to his memory.

 1527-1404/10/080-852/$03.00